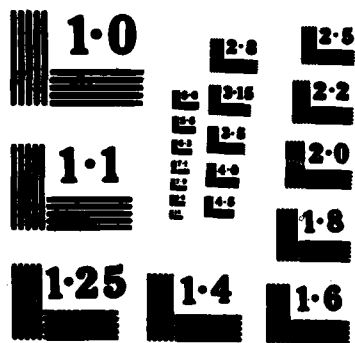


AD-A202 371

STUDIES TOWARD OBSERVING AND MODELLING LARGE ENERGETIC  
OCEAN REGIONS(U) MASSACHUSETTS INST OF TECH CAMBRIDGE 1/1  
DEPT OF EARTH ATMOSPHERI C WUNSCH 20 NOV 88  
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| Annual Report: Studies toward observing and modelling large energetic ocean regions. |       |  |  |  |             |                            |
| 12. PERSONAL AUTHOR(S) Dr. Carl Wunsch   |       |  |  |  |             |                            |
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| FIELD  | GROUP | SUB-GROUP                                    | Physical oceanography, acoustic tomography,<br>satellite altimetry, Gulf Stream. (SDW) ✓ |  |             |                            |
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Progress Report for Year 3  
Grant #N00014-85-J-1241

We have continued our work on the diverse activities focussed on the near-Gulf Stream system, with emphasis on modelling and the combination of data with models, particularly altimetry and scatterometry. The orderly progress of the work was disrupted by the unexpected great instabilities of URIP funding, with some diversion from the original plans made necessary to maintain a group in being (the two programs are closely related). Work on the grant has been a collaborative effort of Profs. Malanotte-Rizzoli, Young, Flierl, and the chairholder. Prof. Young has departed to take up a position at Scripps and will not participate in the fourth year.

Prof. Flierl and Dr. Steve Meacham have continued their studies of the application of contour dynamics to energetic flow fields. They have developed a two-layer, periodic contour dynamics model suitable for numerically simulating simple quasigeostrophic baroclinic jets having piecewise uniform vorticity. Using this, they have studied the effect of varying the horizontal and vertical structure of the jet on the evolution of isolated meanders. Behavior such as meander occlusion and shingle formation depends on the assumed jet vorticity structure in a way that correlates with the linearised stability properties of the jet. In particular, results that more closely resemble processes observed in satellite derived IR pictures of Gulf Stream meanders are obtained when the model is configured with a jet separating two pools of potential vorticity. The model is being extended to a larger domain and switching to forcing at the jet inlet so as to study the development of a series of meanders.

Prof. Rizzoli, with Dr. Roberta Young, have extended their primitive equation model to forcing at the inlet (a figure is attached showing the behavior of the jet through time). Eventually, this model (see Malanotte-Rizzoli, et. al, 1989 in references) will be used in combination with the altimetric and other data.

The work of Prof. Young with visitor S. Sakai has been completed and written up in papers given in the reference list. Another visitor, Y. Hayashi, has returned to Japan and is completing his work there.

I. Fukumori is nearing completion of his Ph.D. thesis (expected near the end of calendar 1988). The thesis is a study both of the circulation of a Gulf Stream ring by inverse methods, as well as the application of general mathematical procedures to hydrographic data optimization. This last study will lead in the fourth year of the grant to a combination of hydrography with altimetry in the entire North Atlantic Ocean.

Two Naval Officers, K. Holderied and J. Campbell, both completed SM theses with research support from the Chair. The former discussed the use of scatterometer data in the vicinity of the Gulf Stream, and the latter studied the GEOSAT data set in detail in the region lying between Hawaii, the Aleutians and the U.S. west coast.

The Chair holder, C. Wunsch, has been extending the general studies of how best to use data with models and has written several papers, both tutorial and as applied to real observations. In general terms, it is clear that all data/model use is ill-posed, data always containing errors. Control theory provides a general and very powerful framework for the general study of models and data. These methods are believed likely to revolutionize the use of oceanic models - but it will take some time to learn how to apply the methods in the best fashion. A specific application of altimetry and control methods to the Gulf Stream region is described in the paper by Gaspard and Wunsch.

Five new tomographic instruments were deployed from R/V Oceanus within the Gulf Stream system at about 55°W in October 1988 and will remain in place until August 1989. Along with three French instruments, they provide a test for a new generation of tomographic instruments which, it is hoped, will become an operational system for routine use. The array overlaps a SYNOP current meter array, and if the instruments work to specification, they should produce a very interesting first direct measurement of oceanic vorticity gradients within and south of the Gulf Stream.



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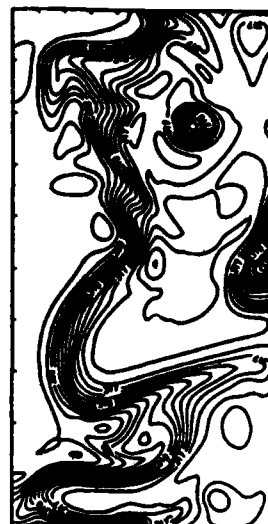
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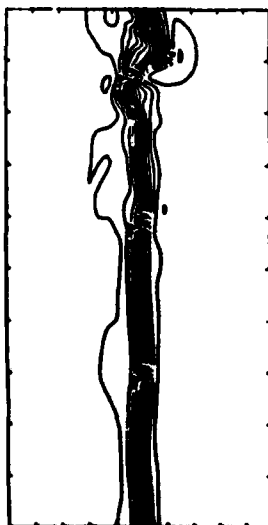
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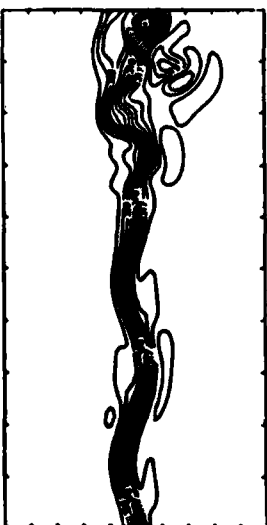
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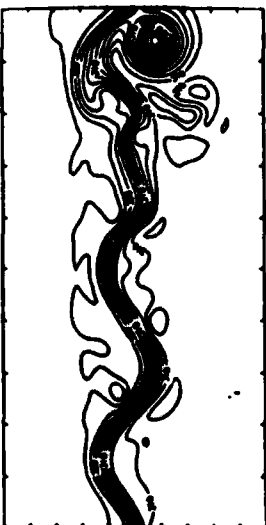
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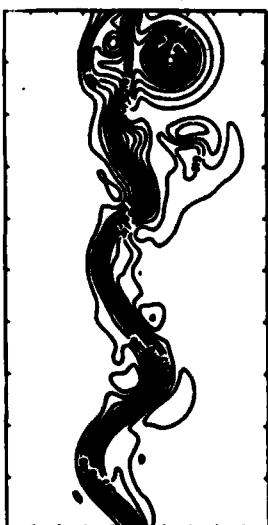
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